OWNERS MANUAL
V2.0

WATERLOG H-3123

SUBMERSIBLE PRESSURE SENSOR WITH SDI-12 OUTPUT

D66 0815

YSI
a xylem brand

CONTENTS & WARRANTY

This user manual is a guide for the H-3301/3311 shaft encoder. For more information, updated manuals, brochures, technical notes, and supporting software on the H-3301/H-3311 shaft encoder, please refer to waterlog.com or contact your sales representative.

For additional assistance, please contact us at +1.435.753.2212 or sales@waterlog.com

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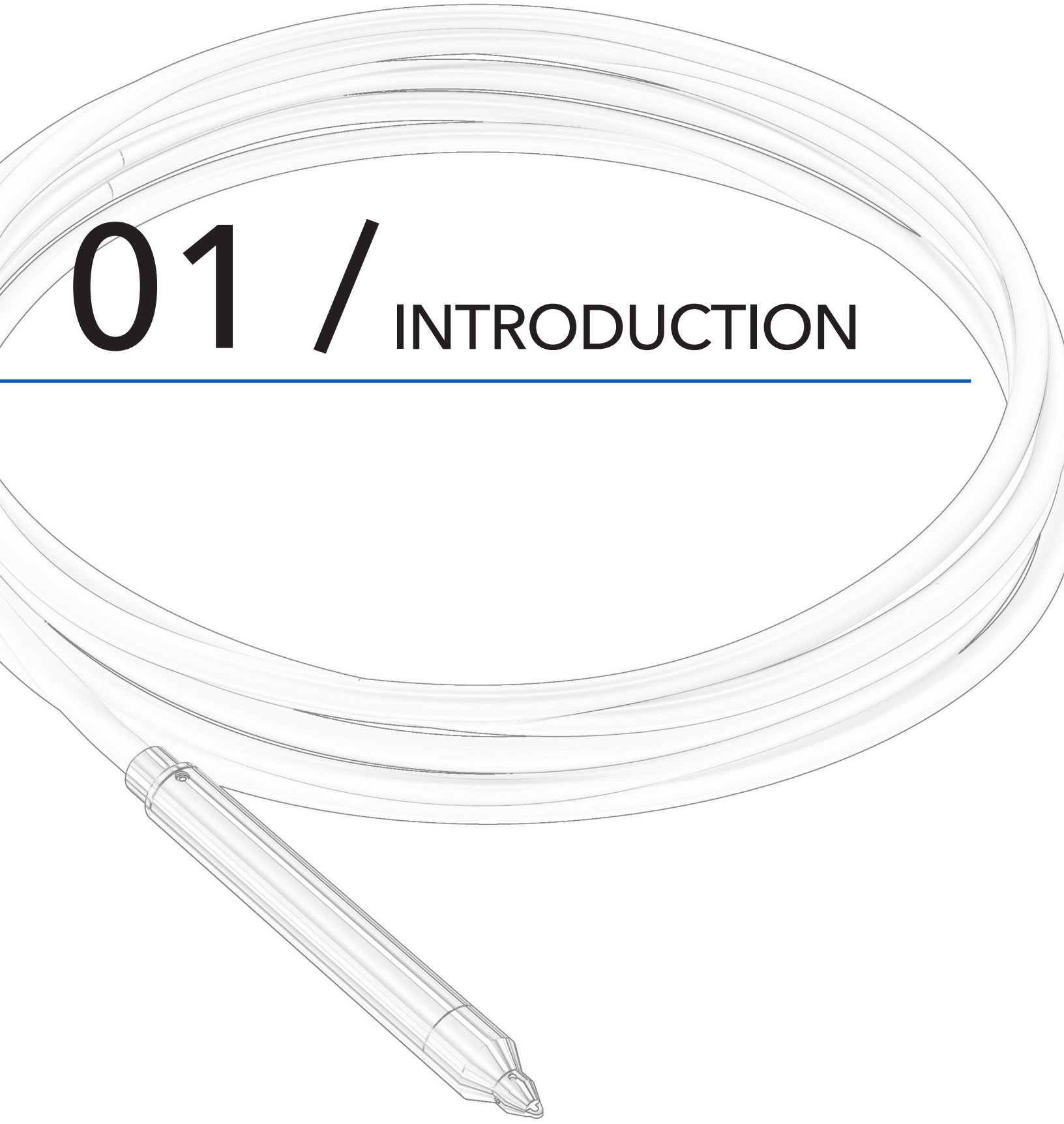
01 / INTRODUCTION



The WaterLOG® H-3123 is a submersible pressure transducer specifically designed for water level monitoring. The H-3123 is easy to use and works with any SDI-12 data recorder. The "Serial-Digital Interface" is ideal for data logging applications with the following requirements.

- Battery powered operation with minimal current drain
- Pressure measurement data is transmitted digitally over long cable lengths without error
- Multiple sensors on a simple three-wire cable
- Up to 250 feet of cable between a sensor and the data recorder (Use of H-423, SDI-12 to RS-485 converter extends the range to 1000's of feet)

Key Features

- Simple to install, use and maintain (no on-site calibration required)
- Performs extremely accurate measurements
- Linear deviation is less than 0.02%
- Resolution is 1 part in 1,000,000
- Accuracy over temperature range exceeds ±0.02 ft. of water
- Enclosure is non-conductive and corrosion proof
- Stainless steel sensor diaphragm
- Sensor cable has internal atmospheric vent for compensation of barometric pressure changes
- Junction box provides access for inspection and maintenance of dry-air desiccant
- Low current operation (less than 500 microamps typical standby)
- Suspension bail provides positive control of the sensor depth independent of temperature and age dependent changes to the sensor cable
- Extended SDI-12 commands for setting the Stage to the current water elevation

What's In The Box

- (1) WaterLOG H-3123 pressure transducer with polyurethane vented cable and dry air junction box
- (3) Spare desiccant packs
- (1) Owner's Manual

INTRODUCTION

Check The Sensor Cable

Be sure that the vented cable is long enough to reach from the submerged location to the junction box of the dry air system. Also, be sure that the data logger cable is long enough to reach from the dry air junction box to your data recorder.

Check The Model Number

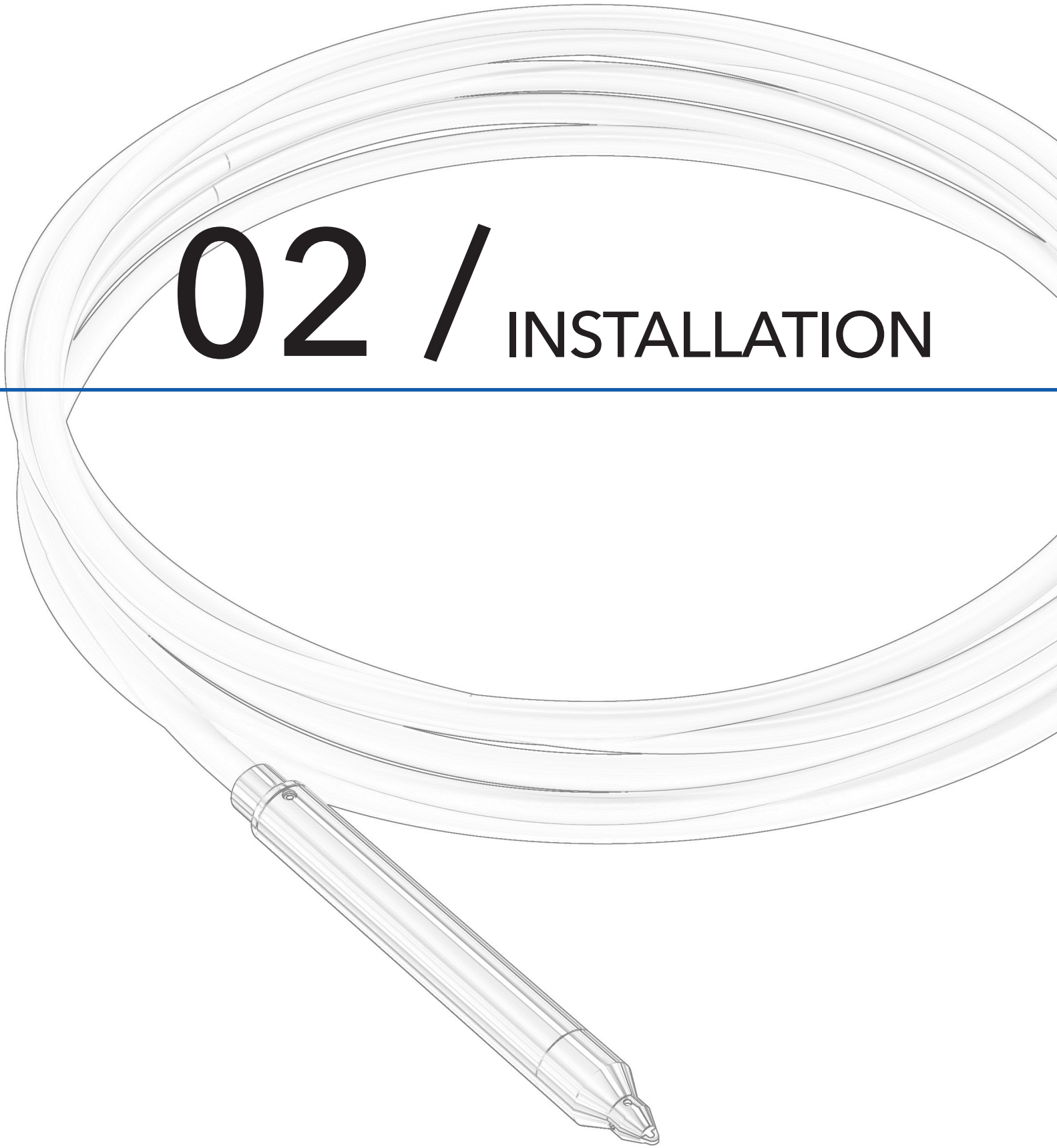
Before installing your new WaterLOG H-3123, check the information on the label of the sensor enclosure. Check the model number, the range, and the output type to be sure that you have received the instrument you ordered. The label will look similar to the following:

H-3123
Model

Submersible Pressure Sensor

S/N 1103
Range: 0-15 PSI (34.6' H20)
Output: SDI-12
Input: 10 to 16.0 Volts
Contains No User Serviceable Parts

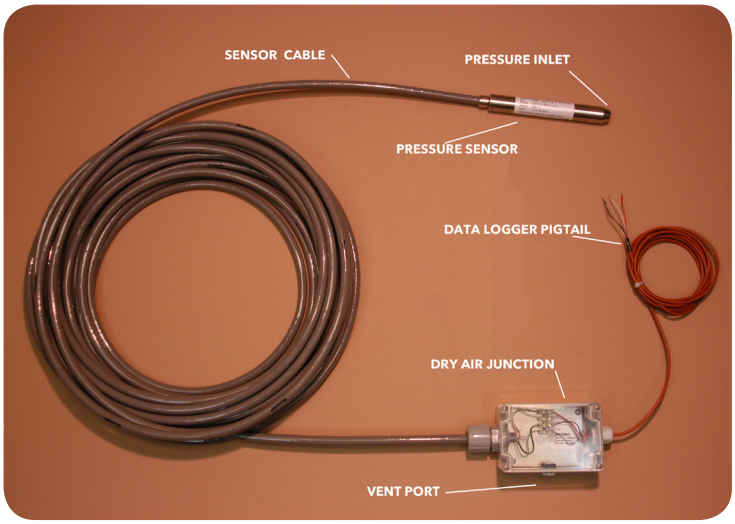
This example shows that the waterLOG H-3123-15 measures pressure within the range from zero to 15 psi. This model works with a recording device that follows the SDI-12 protocol.



02 / INSTALLATION

INSTALLATION

The H-3123 submersible pressure sensor is very versatile and can be used in many water monitoring applications. Before proceeding with the installation, please consider several site preparation and maintenance issues:



System Components

Water Depth

The following chart shows the maximum depth to which the H-3123 is factory calibrated. The sensor can survive temporary operation up to twice the maximum rated depth for your model's range. However, any pressure measurements made beyond the rated depth will be inaccurate. The H-3123 will be damaged if it is placed deeper than twice the maximum rated depth.

Note: Depth calculations are derived from the standard equation that one PSI is generated by a column of water 27.680 inches deep at 39.4 °F.

Model	Pressure Range	Depth Range*	Accuracy
H-3123-15	0 to 15 psi	0 to 34.60 ft.	±0.007 ft.
H-3123-30	0 to 30 psi	0 to 69.20 ft.	±0.014 ft.

General Installation Recommendations

The sensor must be located in a no flow area. Alterations in water flow can cause pressure variations. Thus, if the sensor is subjected to open flow changes, your water level measurements will be inconsistent. **To obtain accurate and reliable data, use stilling wells, sand points, or other "no flow" installation techniques.**

The H-3123 submersible pressure transducer is not recommended for use in applications where silt and mud are problematic. In addition, if the sensor is used in a shallow water application with a chance to dry out with mud coating the sensor diaphragm, the diaphragm compliance will be altered and the factory calibration spoiled.

The H-3123 sensor will be permanently damaged if it is frozen. Transducers which are installed in geographical areas with harsh winters should be removed for the winter unless they are installed deep enough in the water with no danger of freezing. Ice may form around the sensor cable without causing damage or performance degradation. However, the cable should be protected to minimize the possibility of incurring damage as the ice shifts or breaks up during times of thawing.

The polyurethane drop cable is suitable for immersion, direct burial and is somewhat ultraviolet (UV) resistant. Whenever possible, precautions should be taken to protect the cable from direct sunlight, rodents and mechanical damage.

Experience has shown that if a portion of the H-3123 housing or the sensor cable is installed above the water and exposed to sunlight (e.g. installed in shallow water), a temperature gradient can occur inside the enclosure and vent tube. As the air temperature changes, the air density changes. A change in the air density inside the sensor or vent tube column causes a partial pressure on the reference side of the sensor which will raise or lower the H-3123s pressure reading. This is a "law of physics" problem not unique to WaterLOG Series transducers. It can be avoided by installing the transducer in a horizontal position to ensure the entire enclosure is covered by water. Protect the sensor cable so it remains at the temperature of the surrounding air and is not heated directly by the sun.

Stilling Wells

The H-3123 can be hung in well bores, stilling wells and stand-pipes, and can be installed by suspending the sensor using its polyurethane electrical cable.

When installing the H-3123 in wells or stand pipes, make certain the surface of the water in the pipe is open to the atmosphere. Well pipes are often capped with a sanitary well seal or locking cap. Make certain the well cap has a suitable hole or screened vent.

Vertical Position H-3123

Dry Air Junction Box

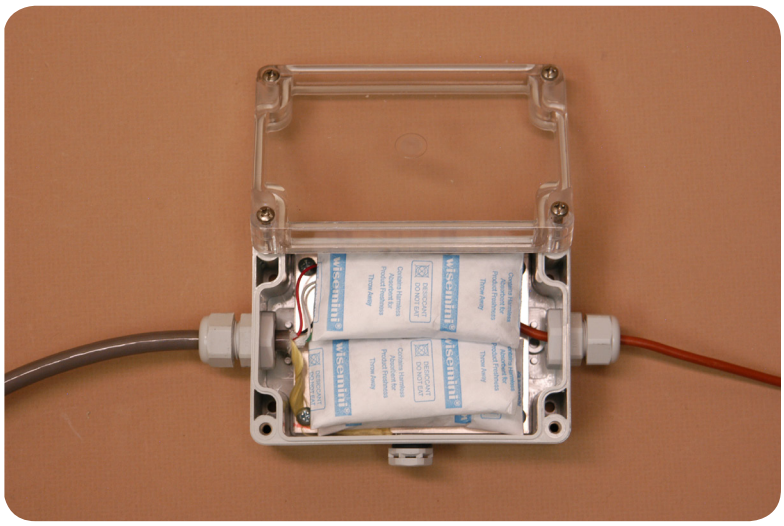
The surface of the water being measured is exposed to atmospheric pressure, therefore submersible pressure sensors must provide correction for changes in barometric air pressure. Several industry designs employ a sealed sensor housing and measure the atmospheric pressure separately. This sheme however, doubles the offset drift because two pressure sensors are needed. To provide the best accuracy possible, the H-3123 uses an atmospheric referenced pressure sensor design. The pressure sensor in the H-3123 has an internal vent tube to compensate for the atmospheric pressure changes. This vent tube passes up the drop cable and is open to the atmosphere at the top. Vent tube designs however, are susceptible to moisture condensation in the tube. As the atmospheric pressure changes, small amounts of air flow up and down the vent tube. Convection can also contribute to airflow within the vent tube. If the vent tube is colder than the dew point of the air, moisture will condensein the tube. This condition occurs continually because the submerged portion of the vent tube is maintained at the water temperature.

INSTALLATION

The temperature of both surface and ground water are normally well below the dew point of the surrounding air.

The H-3123 dry air junction box provides for terminating the polyurethane sensor cable and contains desiccant to keep the atmospheric vent tube dry. The enclosure has a transparent lid which allows visual inspection of the desiccant packs. The enclosure has a small screened vent port in the top cover which exposes the sensor vent tube to the atmosphere.

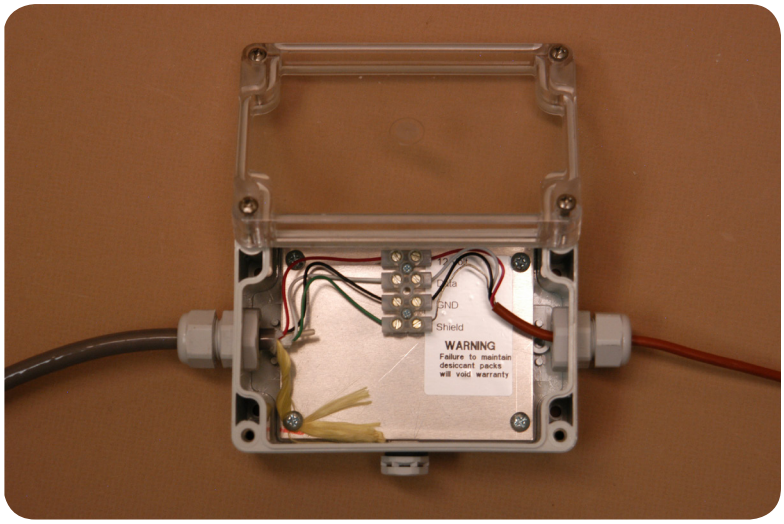
The dry air junction box should be installed in a protected, dry location such as an instrument shelter. The installation should provide easy access and facilitate regular inspection and maintenance of the desiccant.



Dry Air Junction Box

Making Connections to the H-3123

The H-3123 is an SDI-12 V1.3 compliant sensor. It connects directly to any data recorder with SDI-12 capability. The dry air junction box has a 4-conductor pigtail cable for making connections to your data logger. The pigtail cable can be modified or replaced for making connections to your data logger. The pigtail cable can be modified or replaced in the field. The table below shows the proper connections to the pigtail. The power for the H-3123 is supplied by the SDI-12 +12V input. The connections are also shown on a wiring diagram inside the dry air junction box.



Dry Air Junction Box Wiring

If the polyurethane cable between the H-3123 sensor and the dry air junction box must be routed through a conduit or small hole, the polyurethane cable can be temporarily disconnected from the dry air junction box as needed. Reconnect the sensor cable as shown in the table on page 9.

Data Logger Connections	
Wire	*Name*
Red	+12Volt DC
White	SDI-12 Data
Black	Ground
Shield	Ground

Wiring and Installation Precautions

- The shield in the hook-up cable must be connected to the data logger ground.
- The data recorder must be earth grounded.
- The H-3123 requires that the water be at ground potential. Mother Nature takes care of this for surface and ground water.
- Make certain the seals in the liquid tight cable fittings on the dry air junction box are tight.
- Make certain the dry air junction box lid is screwed on and sealed properly.
- Make certain the vent port on the dry air junction box is not covered or blocked.
- Make certain the end of the vent tube inside the dry air junction box is not plugged or blocked.
- Check the desiccant packs. Replace if necessary.

H-3123 Sensor Connections	
Wire	*Name*
Red	+12Volt DC
White	SDI-12 Data
Black	GND
Green	Shield

Programming Your Data Recorder

You must prepare your data recorder to receive and record the H-3123 data. Since data recorders differ widely, refer to your specific recorder manufacturer's directions. In general, program the data recorder to input four values via the SDI-12 port. Usually only one or two of the parameters is actually recorded. Your data recorder must issue an "aM!" command, then collect the data with a "aD0) command, as explained in Chapter 4. The H-3123 places four parameters in its data buffer:

a+AA.AAA+BB.BBB+CC.C+DD.D<cr><lf>

Where:

a	=SDI-12 address 0-9, A-Z
AA.AAA	=Stage (feet, inches, meters, etc.)
BB.BBB	=Pressure (PSI)
CC.C	=Temperature (C)
DD.D	=Sensor Supply Voltage (Volts)

Programming The SDI-12 Address

If more than one sensor is to be connected to the SDI-12 bus, make certain each sensor has a different address. The H-3123 comes from the factory with its address set to "0". The address can be changed with an extended SDI-12 command (see Chapter 4).

Programming The H-3123 Sensor

The H-3123 comes from the factory with the following settings:

SDI Address: 0
Slope: 2.3067 (feet of H_20)

Offset: 0.00
MeanCount: 16

With these values, the Stage will be in units of feet when used in clean water. The slope can be changed to accommodate other engineering units such as inches or meters. The setups are stored in Flash memory within the H-3123 and will not be lost if the power is disconnected. The extended commands for changing these setups are described in detail in Chapter 4.

MeanCount is the number of raw pressure measurements averaged together to make one SDI-12 measurement sequence. This setting determines how long the sensor will take to make a measurement. *MeanCount* can be changed as described in Chapter 4.

Setting the Stage

Many applications use the pressure sensor in a stilling well. The submerged sensor translates pressure to water level. When the H-3123 is first installed, you will want to adjust the *Offset* such that the SDI-12 measurement data (*Stage*) corresponds to the current water elevation or stage as determined with a staff gauge or other datum.

An extended SDI-12 command is convenient to quickly set the H-3123's *Stage* reading to match the current water level. The "aXSCSdd.d!" command causes the H-3123 to make a fresh measurement and automatically update the *Offset* as needed to produce the desired *Stage*. See Chapter 4 for details.

Example of a H-3123 Extended "Set Current Stage" Command:

Command	Response	Time	Values	Description
"aXSCS2.3!"	"a0031<cr><lf>"	3sec	1	Set the *Stage* to 2.3

Subsequent Command	Response	Description
"aD0"	a+12.80<cr><lf)	The new *Offset*

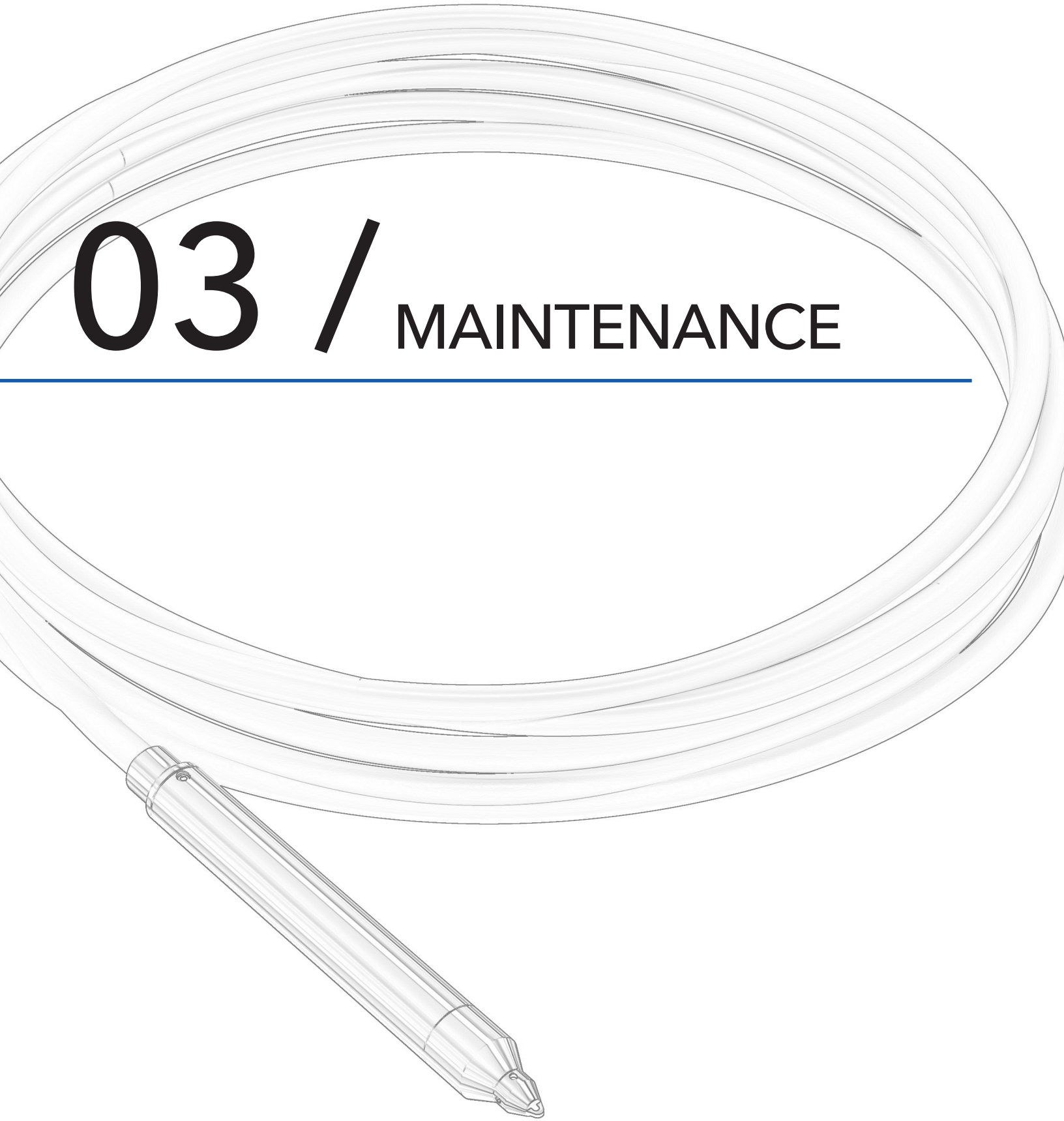
Where:
a =Sensor Address ("0-9", "A-Z", "a-z", "*", "?").

Testing

Before installing the H-3123 in your field location, you may wish to first test the sensor and data logger in your shop or lab. This allows you to become familiar with H-3123 and the data logger in a controlled environment. The H-3123 can be tested in a bucket of water. However, for this test to work correctly, you must run a wire from the water inside the bucket to the chassis ground of the data recorder. The wire establishes a ground connection between the water and the data logger. Water and other conductive objects isolated by a plastic bucket or table surface pick up AC noise from nearby lighting and power lines. The AC noise is coupled by the water to the stainless diaphragm in the submerged pressure sensor. While the H-3123 has a conductive

housing, it is electrically isolated from the rest of the circuitry to prevent galvanic corrosion from occurring. This makes it so the circuitry is also isolated from the surrounding water. The AC noise may affect the pressure measurement due to large voltages between the water media and the sensor (data logger) ground. This precaution is not necessary for field installations because surface water and ground water are not isolated from earth ground.

03 / MAINTENANCE



Sustained operation of the H-3123 pressure sensor is almost maintenance free. Experience has shown that moisture condensing in the atmospheric reference tube creates the largest percentage of field problems. The desiccant in the H-3123 junction box dry air system should be changed on a fixed schedule, normally every three to six months. Different areas in the world have widely varying humidity and temperature fluctuations. Pay close attention to the desiccant condition in your particular installation. The desiccant packs contain indicating silica gel and have a transparent window that allows the condition of the desiccant to be observed. The silica gel has a blue color when dry and changes to pink as it absorbs moisture.

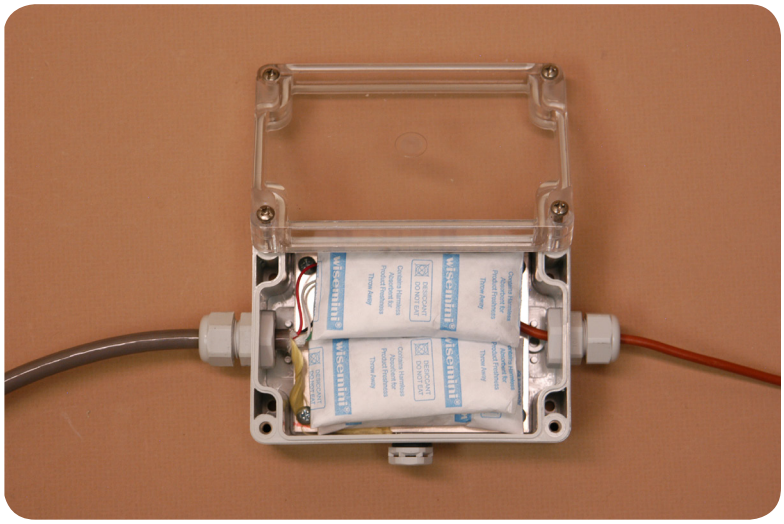
Changing the Desiccant

To change desiccant in the H-3123 junction box dry air system:

Step 1: Remove the clear plastic lid.
Step 2: Replace the desiccant packs.
Step 3: Reinstall the clear plastic lid.

Precautions

- Make certain the seals in the liquid tight cable fittings on the dry air junction box are tight.
- Make certain the dry air junction box lid is screwed on and sealed properly.



Dry Air Junction Box

Maintaining Desiccant Packs

The desiccant bags have a transparent strip which allows the condition of the desiccant to be visually checked. The desiccant has a dark blue color when dry and changes to pink as it absorbs moisture. The desiccant packs can be reused by drying them in an oven at 180 °F to 220 °F for 4 to 8 hours or until the desiccant returns to a dark blue color.

Trouble Shooting

Experience over the years with submersible sensors has identified several common problems:

No SDI-12 response or intermittent data

1. Check all wiring including power and ground connections. Battery connections can become corroded over time.
2. The H-3123 measures and reports it's internal power supply voltage along with Stage and Pressure. Make a measurement and check to see if the coltage is between 10.0 to 16.0 Volts.
3. Check the connections between your data recorder and the H-3123 sensor.

Data Logger Connections	
Wire	*Name*
Red	+12Volt DC
White	SDI-12 Data
Black	Ground
Shield	Ground

Offset Drift

Check the desiccant packs. If moisture accumulates in or blocks the vent tube, changes in barometric pressure will affect the pressure measurement. If this is the case, you should contact WaterLOG technical support for instructions as how to proceed.

04 / SDI-12 COMMAND & RESPONSE PROTOCOL

This is a brief description of the Serial Digital Interface (SDI-12) Command and Response Protocol used by the WaterLOG Series Model H-3123 sensor. Included is a description of the commands and data format supported by the H-3123.

Refer to the document "A SERIAL DIGITAL INTERFACE STANDARD FOR HYDROLOGIC AND ENVIRONMENTAL SENSORS". Version 1.3 january 12, 2009 Coordinated by the SDI-12 Support Group, 135 East Center, Logan, Utah.

During normal communication, the data recorder sends an address together with a command to the H-3123 SDI-12 sensor. The H-3123 then replies with a "response". In the following descriptions, SDI-12 commands and responses are enclosed in quotes. The SDI-12 address and the command/response terminators are defined as follows:

"a"	Is the sensor address. The following ASCII Characters are valid addresses: "0-9", "A-Z", "a-z", "*", "?". Sensors will be initially programmed at the factory with the address of "0" for use in single sensor systems. Addresses "1 to 9" and "A to Z" or "a to z" can be used for additional sensors connected to the same SDI-12 bus. Address "*" and "?" are "wild card" addresses which select any sensor, regardless of its actual address.
"!"	Is the last character of a command block.
"<cr><lf>"	Are carriage return (0D) hex and line feed (0A) hex characters. They are the last two characters of a response block.

Notes:

- All commands/responses are upper-case printable ASCII characters.
- Commands must be terminated with a "!" character.
- Responses are terminated with <cr><lf> characters.
- The command string must be transmitted in a contiguous block with no gaps of more than 1.66 milliseconds between characters.

To enhance the error detection capability in SDI-12 data collection systems, a variation of the Start Measurement Commands (M!, M1!...M9!), Start Concurrent Measurement Commands (C!, C1!... C9), and Continuous Measurement Commands (aR0!...aR9!) request that the data be returned with a 16 bit Cyclic Redundancy Check (CRC) appended to it. These commands use the existing command letters with a C appended, namely: aMC!, aMC1!... aMC9!, aCC!, aCC1! ... aCC9!, and aRC9!. When these commands are used, the data returned in response to the D commands, or R commands, have a CRC code appended to it.

SDI-12 COMMAND & RESPONSE

SDI-12 Master Command List

Standard SDI-12 commands

Command	Description
aM!	Make Measurement
aMC!	Make Measurement with CRC
aC!	Make Concurrent Measurement
aCC!	Make Concurrent Measurement with CRC
aD0! and aD1!	Send Data
aV!	Verify Sensor
aI!	Send Identification

Extended SDI-12 commands unique to the H-3123

Command	Description
aAn!	Change sensor address
aXSCSddd!	Set current "stage"
aXRS!	Read *Slope*
aXWSddd!	Write *Slope*
aXRO!	Read *Offset*
aXWOddd!	Write *Offset*
aXRMC!	Read *Mean_Count*
aXWMCddd!	Write *Mean_Count*
aXTEST!	Initiate a repeating test printout

Measure Command

The Measure Command causes a measurement sequence to be performed. Data values generated in response to this command are stored in the sensor's buffer for subsequent collection using "D" commands. The data will be retained in the sensor until another "M", "C", or "V" command is executed.

Command	Response	Description
"aM!"	"atttn<cr><lf>"	Initiate measurement

Where:

- a — is the sensor address ("0-9", "A-Z", "a-z", "*", "?")
- M — is an upper-case ASCII character
- ttt — is a three digit integer (000-999) specifying the maximum time, in seconds, the sensor will take to complete the command and have measurement data available in its buffer.
- n — is a single digit integer (0-9) specifying the number of values that will be placed in the data buffer. If "n" is zero (0), no data will be available using subsequent "D" commands.

Upon completion of the measurement, a service request "a<cr><lf>" is sent to the data recorder indicating the sensor data is ready. The data recorder may wake the sensor with a break and collect the data any time after the service request is received or the specified processing time has elapsed.

Example of a H-3123 "aM!" command:

Command	Response	Time	Values	Description
"aM!"	"a0044<cr><lf>"	4 sec	4	Make measurement

Subsequent Command	Response
"aD0"	a+AA.AAA+BB.BBB+CC.C+DD.D<cr><lf>

Where:

- AA.AAA = Stage (feet, inches, meters, etc.)
- BB.BBB = Pressure (PSI)
- CC.C = Temperature (C)
- DD.D = Sensor Supply Voltage (Volts)

SDI-12 COMMAND & RESPONSE

Measure Command with CRC

The Measure Command causes a measurement sequence to be performed with a CRC appended to the data. Data values generated in response to this command are stored in the sensor's buffer for subsequent collection using "D" commands. The data will be retained in the sensor until another "M", "C" or "V" command is executed.

Command	Response	Description
"aMC!"	"atttn<cr><lf>"	Initiate measurement

Where:

a is the sensor address ("0-9", "A-Z", "a-z", "*", "?").

MC are upper-case ASCII characters

ttt is a three digit integer (000-999) specifying the maximum time, in seconds, the sensor will take to complete the command and have measurement data available in its buffer.

n is a single digit integer (0-9) specifying the number of values that will be placed in the data buffer. If "n" is zero (0), no data will be available using subsequent "D" commands.

Upon completion of the measurement, a service request "a<cr><lf>" is sent to the data recorder indicating the sensor data is ready. The data recorder may wake the sensor with a break and collect the data any time after the service request is received or the specified processing time has elapsed.

Example of a H-3123 "aM!" command:

Command	Response	Time	Values	Description
"aM!"	"a0044<cr><lf>"	4 sec	4	Make measurement

Subsequent Command	Response
"aD0"	a+AA.AAA+BB.BBB+CC.C+DD.DXXX<cr><lf>

Where:

AA.AAA	= Stage (feet, inches, meters, etc.)
BB.BBB	= Pressure (PSI)
CC.C	= Temperature (C)
DD.D	= Sensor Supply Voltage (Volts)
XXX	=CRC (ASCII Characters)

Concurrent Measurement Command

A concurrent measurement is one which occurs while other SDI-12 sensors on the bus are also taking measurements. This command is similar to the "aM!" command, however, the nn field has an extra digit and the sensor does not issue a service request when it has completed the measurement. Communicating with other sensors will NOT abort a concurrent measurement. Data values generated in response to this command are stored in the sensor's buffer for subsequent collection using "D" commands. The data will be retained in the sensor until another "M", "C", or "V" command is executed.

Command	Response	Description
"aM!"	"a0044<cr><lf>"	Make measurement

Where:

- a — is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
- C — is an upper-case ASCII character
- ttt — is a three digit integer (000-999) specifying the maximum time, in seconds, the sensor will take to complete the command and have measurement data available in its buffer.
- nn — is a two digit integer (00-99) specifying the number of values that will be placed in the data buffer. If "n" is zero (0), no data will be available using subsequent "D" commands.

The data recorder may wake the sensor with a break and collect the data anytime after the specified processing time has elapsed.

Example of a H-3123 "aC!" command:

Command	Response	Time	Values	Description
"aC!"	"a0044<cr><lf>"	4 sec	4	Make measurement

Subsequent Command	Response
"aD0"	a+AA.AAA+BB.BBB+CC.C+DD.D<cr><lf>

Where:

- AA.AAA = Stage (feet, inches, meters, etc.)
- BB.BBB = Pressure (PSI)
- CC.C = Temperature (C)
- DD.D = Sensor Supply Voltage (Volts)

SDI-12 COMMAND & RESPONSE

Concurrent Measurement Command with CRC

A Concurrent Measure with CRC Command causes a measurement sequence to be performed with a CRC appended to the data. Data values generated in response to this command are stored in the sensor's buffer for subsequent collection using "D" commands. The data will be retained in the sensor until another "M", "C" or "V" command is executed.

Command	Response	Description
"aCC!"	"atttnn<cr><lf>"	Initiate measurement

Where:

- a — is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
- CC — is an upper-case ASCII character
- ttt — is a three digit integer (000-999) specifying the maximum time, in seconds, the sensor will take to complete the command and have measurement data available in its buffer.
- nn — is a two digit integer (00-99) specifying the number of values that will be placed in the data buffer. If "n" is zero (0), no data will be available using subsequent "D" commands.

The data recorder may wake the sensor with a break and collect the data anytime after the specified processing time has elapsed.

Example of a H-3123 "aC!" command:

Command	Response	Time	Values	Description
"aCC!"	"a0044<cr><lf>"	4 sec	4	Make measurement

Subsequent Command	Response
"aD0"	a+AA.AAA+BB.BBB+CC.C+DD.DXXX<cr><lf>

Where:

AA.AAA	= Stage (feet, inches, meters, etc.)
BB.BBB	= Pressure (PSI)
CC.C	= Temperature (C)
DD.D	= Sensor Supply Voltage (Volts)
XXX	= CRC (ASCII Characters)

Send Data Command

The Send Data command returns sensor data generated as the result of previous "aM!", "aC!", or "aV!" commands. Values returned will be sent in 33 characters or less. The sensor's data buffer will not be altered by this command.

Command	Response
"aD0!" through "aD9!"	"apd.d ... pd.d<cr><lf>"

Where:

a	is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
D0...D9	are upper-case ASCII characters.
p	Is a polarity sign (+ or -)
d.d	represents numberic digits before and/or after the decimal. A decimal may be used in any position in the value after the polarity sign. If a decimal is not used, it will be assumed to be after the last digit.
	For example: +3.29 +23.5 -25.45 +300

If one or more values were specified and a "aD0!" returns no data (<CR><LF> only), it means that the measurement was aborted and a new "M" command must be sent.

Example of a H-3123 "aD0!" command:

Previous Command	Response
"aM!"	"a0044<cr><If>"

Subsequent Command	Response
"aD0"	a+AA.AAA+BB.BBB+CC.C+DD.D<cr><If>

Where:

AA.AAA	= Stage (feet, inches, meters, etc.)
BB.BBB	= Pressure (PSI)
CC.C	= Temperature (C)
DD.D	= Sensor Supply Voltage (Volts)

Continuous Measurements

Sensors that are able to continuously montior the phenomena to be measured, such as a cable position, do not require a start measurement command. They can be read directly with the R commands (R0!...R9!). The R commands work exactly like the D (D0!...D9!) commands. The only difference is that the R commands do not need to be preceded with an M command.

The H-3123 **does not** support the aR0! continuous measurement command because the measurement and math operations require several seconds to complete.

Continuous Measurements with CRC

The H-3123 **does not** support the aRC0! continuous measurement command because the measurement and math operations require several seconds to complete.

SDI-12 COMMAND & RESPONSE

Send Acknowledge Command

The Send Acknowledge Command returns a simple status response which includes the address of the sensor. Any measurement data in the sensor's buffer is not disturbed.

Command	Response
"a!"	"a<cr><lf>"

Where:

a is the sensor address ("0-9", "A-Z", "a-z", "*", "?")

Initiate Verify Command

The Verify Command causes a verify sequence to be performed. The result of this command is similar to the "aM!" command except that the values generated are fixed test data and the results of diagnostic checksum tests. The data generated in response to this command is placed in the sensor's buffer for subsequent collection using "D" commands. The data will be retained in the sensor until another "M", "C", or "V" command is executed.

Command	Response	Description
"aV!"	"atttn<cr><lf>"	Initiate verify sequence

Where:

a	is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
V	is an upper-case ASCII character.
ttt	is a three digit integer (000-999) specifying the maximum time, in seconds, the sensor will take to complete the command and have data available in its buffer.
n	is a single digit integer (0-9) specifying the number of values that will be placed in the data buffer. If "n" is zero (0), no data will be available using subsequent "D" commands.

Example of a H-3123 "aV!" command:

Command	Response	Time	Values	Description
"aV!"	"a0013<cr><lf>"	1 sec	3	Return fixed data and diagnostic data for testing purposes

Subsequent Command	Response
"aD0"	a+123.456+78.9+y<cr><lf>

Key	Description	Units
+123.456	Fixed test data	
+78.9	Fixed test data	
y	ROM checksum test	0=Failed, 1=Passed

Send Identification Command

The Send Identification Command responds with sensor vendor, model, and version data. Any measurement data in the sensor's buffer is not disturbed.

Command	Response
"aI!"	"allccccccccmmmmmmvvvxx...xx<cr><lf>"

Where:

a	is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
I	is an upper-case ASCII character.
ll	is the SDI-12 version compatibility level, e.g. version 1.2 is represented as "12"
cccccccc	is an 8 character vendor identification to be specidied by the vendor and usually in the form of a company name or its abbreviation.
mmmmmm	is a 6 character field specifying the sensor model number.
vvv	is a 3 character field specifying the sensor version number.
xx...xx	is an optional field of up to a maximum of 13 characters to be used for serial number or other specific sensor information not relevant to operation of the data recorder.

Example of an "aI!" command:

"a12 DAA H-3123vvvS#nnnnnnVhhh<cr><lf>"

H-3123 implementation of the optional 13 character field:
s#nnnnnnVhhh (12 bytes total)

Where:

"nnnnnn"	is a six character sensor serial number
"hhh"	is a three digit sensor firmwater revision level

SDI-12 COMMAND & RESPONSE

Change Sensor Address Command

The Change Sensor Address Command allows the sensor address to be changed. The address is stored in non-volatile flash memory within the sensor. The H-3123 will not respond if the command was invalid, the address was out of range, or the flash programming operation failed.

Command	Response	Description
"aAn!"	"n<cr><lf>"	Change sensor address

Where:

a	is the current (old) sensor address ("0-9", "A-Z", "a-z", "*", "?"). An ASCII "*" may be used as a "wild card" address if the current address is unknown and only one sensor is connected to the bus.
A	is an upper-case ASCII character.
n	is the new sensor address to be programmed ("0-9", "A-Z").

NOTE: To verify the new address use the "Identify Command."

Example of an "Change Sensor Address" command:

Command	Response	Description
"aA2!"	"2<cr><lf>"	Change sensor address to "2"

Extended Set_Current_Stage Command

The H-3123 processes the pressure sensor input and computes *Pressure* in PSI units. Stage is computed with a *Stage* = *m*Pressure*+b equation. During installation it is convenient to quickly set the H-3123's *Stage* reading to match the current stage or elevation of the water as determined by a staff gauge or other datum. This command causes the H-3123 to make a fresh measurement and automatically update the *Offset* (b) term as needed to produce the desired *Stage*.

Example of a H-3123 Extended "Set Current Stage" command:

Command	Response	Time	Values	Description
"aXSCS2.3!"	"a0031<cr><lf>"	3 sec	1	Set the *Stage* to 2.3

Subsequent Command	Response	Description
"aD0"	a+12.80<cr><lf>	The new *Offset*

Extended Read/Write *Stage_Offset* and Read/Write *Stage_Slope*

The H-3123 processes the pressure sensor input and computes Pressure in PSI units. Stage is computed with a *Stage = m*Pressure*+b equation. The *Slope* (m) and *Offset* (b) terms are programmable, allowing the user to scale the reading into other engineering units. These commands allow the user to read or write (change) the *Stage_Slope* and *Stage_Offset* terms. The slope is set to 2.3067 and the offset to 0.00 at the factory. With the factory default (2.3067) the *Stage* will be in units of water depth (in feet). The new values are stored in non-volatile memory within the sensor. Once the new *Stage_Slope* or *Stage_Offset* value is written to the memory, a copy is sent to the sensor data buffer for verification. This data can be viewed by using a subsequent "D" command. To verify these settings any other time, use the "XRS" or "XRO" commands. This command takes 001 seconds to complete and places 1 value in the data buffer. Use the "aD0" command to collect and view the new slope or offset.

Command	Response	Description
"aXRS!"	"a0011<cr><lf>"	Read *StageSlope*
"aXRO!"	"a0011<cr><lf>"	Read *StageOffset*
"aXWSddd!"	"a0011<cr><lf>"	Write *StageSlope*
"aXWOddd!"	"a0011<cr><lf>"	Write *StageOffset*

Where:

a	is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
XRS	are upper case characters.
XRO	are upper case characters.
XWS	are upper case characters
XWO	are upper case characters.
ddd	is the new slope or offset value (For example: 20.0, 195)

Example of a H-3123 Extended "Read *Stage_Slope*" command:

Command	Response	Time	Values	Description
"aXRS!"	"a0011<cr><lf>"	1 sec	1	Read *StageSlope*

Command	Response	Description
"aD0!"	"a+1.00<cr><lf>"	*StageSlope* is 1.00

Example of a H-3123 Extended "Write *Stage_Slope*" command:

Command	Response	Time	Values	Description
"aXWS1.234!"	"a0011<cr><lf>"	1 sec	1	Write *StageSlope*

Command	Response	Description
"aD0!"	"a+1.234<cr><lf>"	*StageSlope* is 1.234

Extended Read *Mean_Count* and Write *Mean_Count*

The H-3123 makes multiple raw sensor measurements, discards the high and low values, integrates (averages) the measurement data and computes *Pressure* (PSI). The number of raw sensor measurements made for each SDI-12 measurement sequence is programmable. When measuring turbulent water, tides or other special applications *Mean_Count* can be changed to increase or decrease the number of pressure measurements made during the SDI-12 measurement sequence.

The H-3123 makes 7-1/2 pressure measurements per second (133ms/measurement). The ttt field in the SDI-12 sensor response is computer by the H-3123 and indicates how much time the H-3123 will require to complete the measurement sequence. The ttt field will automatically change if *Mean_Count* is changed.

The H-3123 comes from the factory with Mean_Count set to 16. The factory default ttt field is computed internally by the H-3123 as follows:

Raw Measurements:	+2.13 sec (0.133 sec/measurement X 16 measurements)
Math Overhead:	+0.3 sec
Round Upwards	+1.0
	----------
ttt	3.0 Seconds

The "aXRMC!" and "aXWMC!" extended commands allow the number of raw sensor measurements for each SDI-12 measurement sequence to be monitored or changed.

Once a new Mean_Count value is written, a copy is sent to the sensor data buffer for verification. This data can be viewed by using a subsequent "D" command. To read or verify the value any other time, use the "XRMC" command.

Command	Response	Description
"aXRMC!"	"a0011<cr><lf>"	Read *Mean_Count*
"aXWMCn!"	"a0011<cr><lf>"	Write *Mean_Count*

Where:

a	is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
XRMC	are upper case characters

XWMC	are upper case characters
n	is the number of raw measurements wanted

This command takes 001 seconds to complete and places 1 value in the data buffer. Use the "aD0" command to collect and view the current value.

Example of a H-3123 Extended "Read *Mean_Count*" command:

Command	Response	Time	Values	Description
"aXRMC!"	"a0011<cr><lf>"	1 sec	1	Read *Mean_Count*

Command	Response	Description
"aD0!"	"a+16<cr><lf>"	Count = 16

Example of a H-3123 Extended "Write *Stage_Slope*" command:

Command	Response	Time	Values	Description
"aXWMC8!"	"a0011<cr><lf>"	1 sec	1	Write *Mean_Count*

Command	Response	Description
"aD0!"	"a+8<cr><lf>"	Count = 8

Extended "XTEST"

This command is used for installation or production testing and requires the use of a H-4191 Sidekick interface and a PC. This command causes the H-3123 to transmit unsolicited real-time data for testing purposes. The test mode is used to help troubleshoot the installation by providing a continuous readout of pressure data. This is not compliant with the SDI-12 specification and is not used with data loggers.

To activate the test mode, send the command "aXTEST!" from the PC. The H-3123 will enter the test mode and make continuous measurements. The test mode is exited by sending a break or any new command on the SDI-12 bus. It may take a few tries to exit if the command is sent at the same time data is being sent from the H-3123. Removing power from the H-3123 also causes it to exit this mode.

Format:
SensorAdr + Stage + Pressure + Temperature + RawPressure (counts) + RawTemperature (counts)

"XTEST" displays the following data:

0: +1.202 +3.222 +23.0 +12345 +67890
0: +1.212 +3.232 +23.0 +12345 +67890
0: +1.222 +3.342 +23.0 +12345 +67890
0: +1.232 +3.352 +23.0 +12345 +67890
0: +1.232 +3.352 +23.0 +12345 +67890
etc.

PERFORMANCE			
Accuracy	Pressure	Less than or equal to 0.02% of full scale output (FSO) over temperature range	
	Pressure Hysteresis	Less than 0.02% of FSO	
	Linearity	Less than 0.02% deviation	
	Temperature	Internal temperature ±1°C over temperature range	
	Long-term Stability	Drift is less than ± 0.10% of FSO per year	
Resolution	Pressure	1 part in 1,000,000 (0.0001%)	
	Temperature	1 part in 1,000,000 (0.0001%)	
Range	PSI ranges: 15, 30, 50 or 100		
	Pressure	Depth	Accuracy
	0 to 15 PSI	0 to 34.60 ft. (10.54 m)	± 0.007 ft. (2 mm)
	0 to 30 PSI	0 to 69.20 ft. (21 m)	± 0.014 ft. (4 mm)
General	Pressure Overload	Less than 2 times the rated pressure	
	Media Compatibility	Liquids and gases compatible with stainless steel and polyurethane.	
	Dry Air System	Prevents moisture from condensing in the submersible pressure transducer. Provides compensation for changes in atmospheric pressure without impairing the sensor's accuracy.	
MECHANICAL / POWER			
Size	Housing	0.875 in. max W x 6.5 in. L (22.2 mm x 165 mm)	
Material	Housing	316 L stainless steel with polyurethane vent tubing	
Power Requirements	Voltage Input	9.6 to 16.0 volts DC	
	Current	Standby: 1 mA maximum	
		Active: 15 mA maximum	
Connector	Cables	10 ft. (3.048 m) Cable (H-3123 to junction box): Polyurethane jacket, vented, shielded, three-wire cable. *Stainless steel cable not necessary. UV vented cable sold separately.	
General	Cable Length	Maximum: 1000 ft. (304.8 m)	
	Protection	On-board transient surge protection 1.5KVA	
COMMUNICATION			
SDI-12	Baud Rate	1200	
	Protocol	SDI-12, V1.3	
	Response Time	4-second measurement sequence	

ENVIRONMENTAL		
General	Operating Temperature	0° to 40° C (non-freezing)
	Compensated Temperature	0° to 40° C
	Storage Temperatures	-10° to 75° C
MISCELLANEOUS		
Accessories	H-3123-DAA	Dry Air Assembly
	H-3123-MB	Media Barriers
	H-3123-VC	Vented Cable (price per foot)
	H-3123-H	Vented Cable Mesh Grip Hanger
	H-306	Dry Air System Desiccant Pack (10/pack)
Warranty	The WaterLOG® H-3123 is warranted against defects in materials and workmanship for one year from date of shipment.	
Note	Specifications subject to change without prior notice due to ongoing commitment to product testing and improvement. LR September, 2014. (D06-03 0914)	

Xylem

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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